OWMC

Ontario
Waste Management
Corporation

a crown agency

TO23613.A0

REPORT ON SPECIAL WASTE GENERATION BY THE NON-INDUSTRIAL SECTOR IN ONTARIO

Prepared for
Ontario Waste Management Corporation

by
CANVIRO Consultants
A Division of CH2M HILL ENGINEERING LTD.

JUNE 1988

TABLE OF CONTENTS

	Page
EXECUTIVE SUMMARY	i
CHAPTER 1: INTRODUCTION	
1.1 Background	1-1
1.2 Objectives	1-1
1.3 Report Structure	1-2
CHAPTER 2: STUDY METHODOLOGY	
2.1 General	2-1
2.2 Data Collection	2-2
2.2.1 Literature Search	2-2
2.2.2 Telephone Interviews	2-3
2.2.3 Number of Subject Waste Generators	2-3
2.2.4 Pathological Wastes	2-4
2.3 Data Analysis	2-4
2.3.1 Institutional Subject Wastes	2-4
2.3.2 Intermittent Subject Wastes	2-7
2.3.3 Household Subject Wastes	2-8
2.3.4 Commercial/Service Establishment Subject Wastes	2-11
2.4 Regional Breakdown of Waste Generation	2-15
CHAPTER 3: RESULTS	
3.1 General	3-1
3.2 Waste Quantity Generation by Sector	3-3
3.3 Quantities of Waste Generated by Type	3-3
3.4 Quantities of Waste Generated by Region	3-4
3.5 Limitations of Data	3-13
3.5.1 Biomedical/Pathological Wastes	3-13
3.5.2 Spills	3-15
CHAPTER 4: CONCLUSIONS & RECOMMENDATIONS	
4.1 Conclusions	4-1
APPENDIX A - REFERENCES	
APPENDIX B - BIBLIOGRAPHY	
APPENDIX C - LIST OF CONTACTS	

LIST OF TABLES

		Page
TABLE 1.	SUBJECT WASTES PRODUCED BY THE NON-INDUSTRIAL SECTOR IN ONTARIO	3-2
TABLE 2.	SUBJECT WASTES PRODUCED BY THE NON-INDUSTRIAL SECTOR IN OWMC REGION 1	3-6
TABLE 3.	SUBJECT WASTES PRODUCED BY THE NON-INDUSTRIAL SECTOR IN OWMC REGION 2	3-7
TABLE 4.	SUBJECT WASTES PRODUCED BY THE NON-INDUSTRIAL SECTOR IN OWMC REGION 3	3-8
TABLE 5.	SUBJECT WASTES PRODUCED BY THE NON-INDUSTRIAL SECTOR IN OWMC REGION 4	3-9
TABLE 6.	SUBJECT WASTES PRODUCED BY THE NON-INDUSTRIAL SECTOR IN OWMC REGION 5	3-10
TABLE 7.	SUBJECT WASTES PRODUCED BY THE NON-INDUSTRIAL SECTOR IN OWMC REGION 6	3-11
TABLE 8.	DETAILED REGIONAL BREAKDOWN OF HOUSEHOLD WASTES	3-12

EXECUTIVE SUMMARY

PURPOSE OF THE REPORT

The purpose of this report was to quantify the special wastes produced in Ontario by non-industrial sources, which for the purpose of the study included:

(i) Commercial/Service Establishments
(ii) Institutions
(iii) Intermittent Sources (spills)
(iv) Households

SCOPE AND METHOD

Waste generation rates for the sources of interest were obtained from the published literature where possible. When generation rates were not available in published literature, members of the sectors of interest were contacted directly to obtain information on waste generation. In some cases, members of government departments across Canada and the U.S. were contacted to obtain information on specific waste sources.

A Dun and Bradstreet database was used to determine the number of establishments of interest located in Ontario. The number of establishments were multiplied by the waste generation rates described above, to determine a total waste quantity for the Province of Ontario.

A regional breakdown of waste generation was developed by dividing the Dun and Bradstreet data into the six OWMC regions in the Province. Waste quantities for each region were then calculated using the waste generation rates

(developed above) and the number of establishments determined to be located in each region.

PREMISES AND POSTULATES

Certain data provided by OWMC or from other sources were accepted as given factors for the survey including:

1. Waste classification system (UCD).

A number of postulates or assumptions were necessary during the study. These include:

1. The Dun and Bradstreet database (1985) accurately reflects the number of establishments in Ontario in the various SIC groups of interest.

2. Information obtained during telephone interviews with various government and private sector representatives was accurate.

3. Information obtained in the literature on waste generation rates for service industries, small quantity generators and households in the U.S. would also accurately reflect waste generation rates for similar sectors in Ontario.

STATUS OF DATA

Biomedical waste generation rates for hospitals in Ontario were obtained from a report published by the interministry

task force on biomedical waste in 1986. The generation rates were higher than those quoted for pathological waste in a similar study carried out by the Ontario Hospital Association in 1984, but are similar to those found in studies carried out in the U.S. The definition of biomedical waste includes all waste removed from hospital wards, including food wastes etc. which are disposed along with municipal garbage. For the purpose of this study, 1987 manifest data on pathological waste produced by hospitals was used, as most biomedical waste would not be of interest to the OWMC.

Waste generation rates for households were obtained from three sources (Rathje, Blackmar and Tiffany) and were confirmed through discussions with a number of sources in Ontario. The U.S. generation rates are considered applicable in Ontario, and accurate for the purposes of this study.

Information on wastes produced by the recycling industry was obtained through telephone conversations with members of the industry and industry associations. Values found in the literature were lower than those discussed, hence the higher values were used for the study.

Generation rates for a number of service industries were obtained from a major U.S. study of small quantity generators completed by Abt Associates, Cambridge, Mass., in 1986. It was assumed that rates for Ontario industries would be similar to results of the U.S. study. Where it was considered that these rates required clarification (e.g. funeral services) they were confirmed by directly contacting members of the industry in question.

Data on spills in Ontario was obtained from the MOE Spills Action Centre, and reflects the quantity of material spilled, but not the volume of material involved in clean-up activities. It is estimated that this data covers approximately 50% of the spills which occur in Ontario. This is considered a limitation on the data available on this source.

A separate study was carried out on wastes generated by site clean-up and decommissioning activities. The study report, CANVIRO (1988), should be referred to for a detailed discussion on this topic.

Data on wastes produced by the Federal and Provincial Government was limited. Rates obtained for general laboratories and research facilities were applied to government related institutions, and it has been assumed that this accounts for most of the special wastes produced by this source. Accurate data was obtained for all Canadian Forces Bases located in Ontario from the Department of National Defense.

MAIN FINDINGS

The main findings of this study are as follows:

1. Approximately 210,300 tonnes per year of subject wastes is estimated to be produced in Ontario by non-industrial sources addressed in this study. This figure excludes wastes from spill clean-up activities.

2. Three major waste generators account for 89% of the waste produced. These include households, which produce an estimated 41% of the total waste quantity, the vehicle maintenance industry, which produces an estimated 40%, and the recycling industry, which produces a further 8% of the total.

3. Three major waste streams account for 73% of the total waste quantity produced. These major waste types are used oils, which account for 43% of the total, lead acid batteries, which account for 15% of the total, and solvents and paint wastes which together account for 13% of the total.

4. A regional breakdown shows that 39% of the waste is produced by OWMC Region 3, which includes Halton, Peel, Durham, York and Metropolitan Toronto. Approximately 17% of the waste is generated by Region 1 which encompasses most of south western Ontario, and includes Essex, Kent, Elgin, Lambton, Middlesex, Perth, Huron and Wellington. OWMC Region 4 produces an estimated 13% of the total, OWMC Region 2 produces a further 11%, and OWMC Regions 5 and 6 produce a further 10% and 9% each, respectively.

RECOMMENDATION

1. This report should be updated when the results of the studies currently underway by the MOE on wastes produced by the drycleaning and vehicle service industry in Ontario become available.

CHAPTER 1
INTRODUCTION

This chapter includes descriptions of the purpose of the study, and of the report structure.

1.1 BACKGROUND

The Ontario Waste Management Corporation (OWMC) was established as a provincial Crown Agency in 1981 with a mandate for the implementation of a province-wide program for the management of hazardous and liquid industrial waste as currently defined in Regulation 309 and referred to as "subject waste" or simply "waste" in this study.

A critical component of the OWMC FDP (Facilities Development Program) program involves the assessment of the types and quantities of subject wastes generated in Ontario. The assessment data will be used to support planning of waste management facilities to be built by OWMC, and also of programs that will affect the generation and management of waste, such as encouragement of recovery, recycling and re-use practices.

1.2 OBJECTIVES

As part of the data collection effort, OWMC retained CANVIRO Consultants to undertake a study to estimate the quantities

of special wastes generated in Ontario by the following non-industrial sources:

(i) Commercial/Service Establishments
(ii) Institutions
(iii) Intermittent sources such as spills
(iv) Households

The study involved a compilation of available information on waste generation rates from published literature, and application of these rates to establishments located in Ontario.

1.3 REPORT STRUCTURE

The methodology employed in conducting the study is described in Chapter 2. The estimated quantities of waste produced by the sources of interest are presented in Chapter 3 along with a discussion on the limitations of the data. Conclusions and recommendations derived from the study are presented in Chapter 4. Appendices to the report include references, a bibliography, and a list of people contacted during the course of the study.

CHAPTER 2
STUDY METHODOLOGY

This chapter describes the various sources from which data used in the study was collected, how the data was used to develop waste quantities and how a regional breakdown of wastes was carried out.

2.1 GENERAL

The study approach involved three major components. The first component involved data collection from a variety of sources on the types and quantities of subject wastes generated by the non-industrial sector.

The second component involved developing estimates of total quantities of subject waste generated by the non-industrial sector in Ontario. These were obtained by multiplying the specific generation rates developed during the first task, by the appropriate number of establishments in the Province.

The third component involved a breakdown of special waste generation by Region of Ontario. This was accomplished by determining the number of establishments of interest in each region and multiplying waste generation rates by the number of establishments to determine waste quantity generation by region. The six OWMC regions, (as defined in Section 2.4) were used for this breakdown.

2.2 DATA COLLECTION

2.2.1 LITERATURE SEARCH

The Canadian Institute of Scientific and Technical Information (CISTI) and the Industrial and Business Information Service (IBIS) at the University of Waterloo conducted extensive literature searches on the following on-line data bases:

PTS Prompt
Pollution Abstracts
NTIS
Chemical Abstracts
Engineering Index-Meetings
NIOSH (Occupational Safety and Health)
Compendex
Chemical Industry Notes

Data base selection was based on discussions with qualified librarians at both organizations, as well as CANVIRO's past experience in conducting literature searches. Data bases were selected to ensure maximum coverage of all pertinent published literature.

All abstracts obtained through the literature searches were carefully reviewed and any references containing pertinent information were ordered and reviewed in detail.

Full utilization was also made of the resources at the Environment Canada Library in Toronto. A number of reports were reviewed and all pertinent information extracted.

2.2.2 TELEPHONE INTERVIEWS

A number of researchers who have been active in various aspects of subject waste management were contacted by phone. These included selected consultants in the U.S. who have conducted hazardous waste generation surveys, a number of researchers and staff members from the Ontario Ministry of the Environment (MOE), Environment Canada, U.S. Environmental Protection Agency (EPA), selected state environmental agencies in the U.S., and researchers affiliated with Universities in both Canada and the U.S. A listing of people contacted is presented in Appendix C.

Wherever possible, trade associations, professional associations and regulatory bodies were contacted to obtain information on specific waste generators. These included the Ontario Veterinary Association, Recycling Association of Ontario, Health Care Occupational Health and Safety Association, Ontario Funeral Services Association, Catholic Separate School Board, Association of Canadian Re-Refiners and selected universities.

Information on spills in Ontario was obtained from the MOE Spills Action Center.

2.2.3 NUMBER OF SUBJECT WASTE GENERATORS

The Dun and Bradstreet (1986) market survey data base was employed as the main source of information on the number of non-manufacturing establishments of interest in Ontario. This data base utilizes 1977 four digit U.S. SIC (Standard Industrial Classification) codes and provides a breakdown of establishments on a regional basis.

Limited use was also made of the Statistics Canada Business Registry file (1986). The Business Registry provides data on the total number of establishments in Ontario for a

given SIC, but does not provide a breakdown on a regional basis. The registry employs the broadly categorized three digit 1970 Canadian SIC numbers.

A complete listing of hospitals in Ontario was obtained from a Statistics Canada Report (1983).

The number of universities in Ontario and their respective enrollments were obtained from the Directory of Canadian Universities (1985).

2.2.4 PATHOLOGICAL WASTES

Data on pathological wastes manifested in the Province in 1987 was obtained from the Regulation 309 manifest database.

2.3 DATA ANALYSIS

The following sub-sections describe the data employed and assumptions made in developing final generation rates.

2.3.1 INSTITUTIONAL SUBJECT WASTES

For the purposes of this study, institutional wastes were considered to be those produced by the following sources:

(i) Government Institutions
(ii) Hospitals
(iii) Educational Facilities
(iv) Laboratory and Research Facilities

2.3.1.1 Government Institutions

Both Federal and Provincial Government Institutions were considered in this category. Wastes produced by laboratories and Research Institutions run by government agencies are discussed in Section 2.3.1.4. Information on other wastes produced by government institutions was very limited, and no published data was discovered.

Results of an unpublished study carried out by Environment Canada on hazardous wastes produced by Federal Facilities indicated that the Canadian Forces Bases produced the largest variety of special wastes, followed by Agriculture Canada facilities. In the absence of any published data, the Department of National Defence (DND) was contacted directly and data on subject wastes generated by all Canadian Forces Bases in Ontario was obtained.

Data on spent solvent generation by six Federal government departments located in the National Capital Region (Ottawa) which included the Department of National Defence (DND), Agriculture Canada, Health and Welfare Canada, National Research Council, Energy Mines and Resources, and Environment Canada, was obtained from Energy Pathways (1984).

2.3.1.2 Hospitals and Medical Laboratories

Information on biomedical waste generation rates for Ontario hospitals and medical laboratories were obtained from a Report published by the interministry task force on biomedical waste (1986). As most biomedical waste would not be of interest to the OWMC, the study focussed on pathological waste only. Information was obtained from the 1987 Regulation 309 manifest database on all pathological waste manifested in the Province.

2.3.1.3 Educational Facilities

The following services are included in the Educational Facilities Category:

(a) Educational and Vocational Shops
(b) Universities

Subject waste generation rates for educational and vocational shops were obtained from Abt Associates (1985). Discussions were also held with members of school boards in the Metro Toronto area.

Specific data on subject waste generation at selected Ontario universities was obtained through personal contact with officials at the universities in question, as well as from internal OWMC memos (1986). These rates were compared to published data on the University of Minnesota and were converted to a generation rate per student per year. Enrollment at Ontario educational facilities was obtained from the Directory of Canadian Universities (1985).

2.3.1.4 Laboratory and Research Facilities

The following facilities are included in this category.

(a) Research and Development Laboratories
(b) Commercial Testing Laboratories
(c) Dental Laboratories
(d) Science and Research Organizations

The above categories include both Federal and Provincial government facilities.

Subject waste generation rates for Laboratory and Research Facilities were obtained from Abt Associates (1985). No published information was available on biomedical waste generation by dental laboratories.

2.3.2 INTERMITTENT SUBJECT WASTES

For the purposes of this study, intermittent special wastes refer to wastes generated from spills. Site decommissioning and site clean-up wastes are dealt with in some detail in a separate report (CANVIRO, 1988).

Material Generated Through Spills

Historical data on wastes generated by spills in Ontario was obtained from the MOE Spills Action Center (MOE 1987a). The information provided by the MOE was restricted to volumes of spilled fluid, and the volumes of fluid cleaned up, rather than volumes of contaminated material actually resulting from a spill (i.e. contaminated soil, absorbants, etc.). Available data on spilled oil and hazardous liquids (other than oil) in Ontario were averaged from spill records for the years 1981 to 1984. The MOE estimate that this data reflects approximately half of the spills which occur in the province each year, the remaining spills being reported to other agencies. The averaged data was used as an estimate of half of the hazardous liquids that may be spilled annually in Ontario, and was increased by a factor of 2 to develop a total spill quantity estimate. Discussions with MOE and Environment Canada personnel indicate that they expect this figure to remain relatively constant in future years.

Spilled solid materials are not recorded by the MOE, and it was not possible to obtain any information on this topic from other sources.

2.3.3 HOUSEHOLD SUBJECT WASTES

The household subject waste generation rates that were used as well as the references from which the generation rates were derived, are presented below:

Waste Type	Generation Rate (Kg/household/year)	References
Ignitable Paint Waste	5.01	Blackmar, D.S. (1984)
Spent Solvents	0.93	Blackmar, D.S. (1984)
Used Oils	11.97	Tiffany, H.E. (1982)
Anti-freeze	4.17	Rathje, W.L. (1986)
Pesticide Wastes	1.65	Blackmar, D.S. (1984)
Other	1.60	Blackmar, D.S. (1984)
TOTAL	25.33	

The Blackmar (1984) report presented results of a regional hazardous waste collection program conducted in 15 towns in Barnstable County, Massachusetts. In total, 375 households responded to the collection drive. This report provided a detailed breakdown of the various types of wastes collected, and was therefore used to develop annual generation rates for paint wastes, spent solvents, pesticide waste and other miscellaneous wastes. In order to develop generation rates for the above waste categories, it was necessary to assume a time span over which the homeowners accumulated the wastes that were collected during the study. A time span of 5 years was assumed, which was based on discussions with a member of the study team. Based on the fact that approximately 67 percent of the study area population were summer residents, it was felt that clean-up of household hazardous wastes would be performed less frequently than it would be in a "typical" residential area; thus, 5 years was assumed as a representative time span. Rathje (1986) obtained a generation rate of 4.28 Kg/household/year for a combination of paints, solvents and thinners, however, this generation rate was not used in the present study as a disaggregate breakdown was not available. It should be noted that this

rate is similar to the Blackmar (1984) rates actually used in this study.

The generation rate for antifreeze was obtained from the Rathje (1986) study. This was the only study to identify a generation rate for antifreeze.

The generation rate for used oil was obtained from Tiffany (1982). This paper estimated the annual volume of used oil in the United States that was disposed of by homeowners into their garbage, the sewer system or on the ground. The generation rate obtained from this report was felt to be most appropriate as it fell within the median of the range of generation rates obtained from a number of different sources.

A more recent study by Rathje (1987) on the characterization of household hazardous waste from Marin County, California and New Orleans, Louisiana developed generation rates for a variety of hazardous wastes found in household garbage. Based on the results of the study, the report presented a hazardous waste generation rate of 3.0 kg/household/year. The differences between the Rathje (1987) generation rate of 3.0 kg/household/year and the 25.3 kg/household/year used in the present study are addressed below:

- The Rathje (1987) generation rate for used oil was 0.4 kg/household/year compared to the 11.97 kg/household/year obtained in Tiffany (1982). The Rathje (1987) value is at the low end of the various generation rates identified for used oils and is also lower than the 6.7 kg/household/year reported by Rathje (1986). The Tiffany (1982) rate is a total generation rate, which takes

account of waste oil produced by do-it-yourselfers regardless of the disposal method and is probably the most realistic rate to use for the present study.

- The Rathje (1987) generation rates do not include the mass of contaminated containers, rags, paint brushes, etc. only that of the pure chemical. As containers and other contaminated material constitute a major component of the total mass of waste disposed of, this omission from the study data base is probably largely responsible for the discrepency between the Rathje (1987) generation rates and those used in this study.

- Since the Rathje (1987) study was conducted over a limited time span, wastes that are typically stored prior to disposal (eg. paints, solvents etc.) may not have been realistically represented in the garbage. As well, the Rathje values would not account for wastes disposed of by other means (eg. into the sewer system).

- The generation rate for antifreeze used by CANVIRO (4.17 kg/household/year) was obtained from Rathje (1986) and is an average of studies carried out at five municipalities. However, there was a wide variation (0.0 to 5 US gallons/household/year) in the rates for the individual study areas, hence an average rate for the five areas was chosen. In contrast, Rathje (1987) reported a generation rate for antifreeze of less than 0.1 kg/household/year which is similar to the rate quoted for one of the municipalities in the 1986 study. In view of the

above data, it is probably more appropriate to use the higher generation value, which appears to be more realistic.

Discussions with MOE Waste Management Branch personnel indicate that of 9 household hazwaste collection projects carried out in Ontario in 1986, waste crankcase oils and paints accounted for 20% and 50% of the wastes received respectively. An average of 148 homes responded to the programs, producing approximately 25 Kg of subject waste per home.

2.3.4 COMMERCIAL/SERVICE ESTABLISHMENT SUBJECT WASTES

For the purposes of this study, commercial/service establishment special wastes were considered to be those generated by the following sources:

(i) Photographic Sector
(ii) Laundries and Dry Cleaners
(iii) Pesticide End Users
(iv) Pesticide Application Services
(v) Recyclers
(vi) Vehicle Maintenance Services
(vii) Funeral Services
(viii) Building Cleaning and Maintenance
(ix) Equipment Repair Services
(x) Wholesale and Retail Sales

2.3.4.1 Photographic Sector

The following services and/or establishments are included in this sector for the purpose of this study.

(a) Blueprinting and Photocopying Services
(b) Commercial Photography Establishments

(c) Photofinishing laboratories
(d) Museums and Art Galleries

Museums and Art galleries are included in the above group as the wastes they produce are similar to those produced by the other services.

Subject waste generation rates for the above services were obtained from Abt Associates (1985).

2.3.4.2 Laundries and Dry Cleaners

Waste generation rates for dry cleaning and laundry establishments were obtained from Abt Associates (1985). The MOE Waste Management Branch has recently conducted a survey of dry cleaners in Ontario to determine their waste management practices. The results of this survey will include an estimate of the types and quantities of waste produced by this sector in Ontario, but were not available at the time of writing this report.

2.3.4.3 Pesticide End Users

Public golf courses and botanical and zoological gardens were identified as major generators of pesticide wastes. In addition, farmers, municipalities, campgrounds and parks are also pesticide end users. Specific waste generation rates for these pesticide end users were obtained from Abt Associates (1985). The generation rate for these is lower than for pesticide application services, hence they are shown separately on the summary table.

2.3.4.4 Pesticide Application Services

In addition to the Pesticide End Users, the following commercial establishments generate pesticide wastes.

(a) Disinfecting and Exterminating Services
(b) Lawn and Garden Services
(c) Ornamental Shrub and Tree Service
(d) Sanitarial Services
(e) General Crop Services including Planting, Cultivation and Protection
(f) Soil Preparation Services

Waste generation rates for the above listed pesticide application services were obtained from Abt Associates (1985).

2.3.4.5 Recyclers

Information on the types and generation rates of wastes produced by solvent recyclers was obtained from an OWMC report (OWMC, 1983) and through discussions with members of the industry.

Information on waste generation rates from the waste oil recycling industry was obtained from an OWMC report (OWMC, 1983) and through discussions with a representative of the Association of Canadian Re-refiners. Information on waste generated by other recycling operations was not discovered in published literature.

2.3.4.6 Vehicle Maintenance Services

The following services are included in the vehicle maintenance category.

(a) Automotive Repair Shops
(b) Automotive Dealers
(c) Gas Stations
(d) Car and Truck Rental Services
(e) Farm Machinery Maintenance

(f) Construction Vehicle Maintenance
(g) Mobile Home Dealers
(h) Motor Freight Terminals
(i) Trucking
(j) Utility Trailers and Recreational Vehicle Rentals
(k) Railway and Marine Sectors

Used oil generation rates for the above sectors were obtained from an Environment Canada report (1985). Generation rates for other wastes produced by the above sectors, were obtained from Abt Associates (1985).

The MOE is currently conducting a study of vehicle maintenance facilities in Ontario to determine their waste management practices. The quantity and type of waste produced by the industry in Ontario will be determined during the course of this study. This information was not available at the time of writing this report.

2.3.4.7 Building Cleaning and Maintenance

Generation rates for wastes produced by the building cleaning and maintenance sector were obtained from ABT Associates (1985).

2.3.4.8 Funeral Services

Generation rates for wastes produced by funeral services were obtained from Abt Associates (1985). These rates were confirmed through discussions with the director of a funeral service establishment located in Metropolitan Toronto.

2.3.4.9 Equipment Repair Services

For the purposes of this study, equipment repair services include the following establishments:

(a) Electrical Repair Shops
(b) Armature Rewinding Shops
(c) Amusement Parks
(d) Automotive Merchandising Machine Operators
(e) Communication and Pipeline (except natural gas) industries

Waste generation rates were obtained from Abt Associates (1985).

2.3.4.10 Veterinary Services

It was assumed that some wastes of interest would be generated by veterinary establishments in Ontario. No information on this topic was discovered in the literature, and a number of contacts were initiated with sources such as the Ontario Veterinary Association, members of the faculty at the University of Guelph, Humane societies, private animal hospitals and private veterinary practices. However an estimate of subject waste generation rates by this sector was not available.

2.4 REGIONAL BREAKDOWN OF WASTE GENERATION

The six OWMC Regions used for the Regional breakdown of waste generation are as follows:

Region 1 - Essex, Kent, Elgin, Lambton, Middlesex, Huron, Perth, Waterloo, Wellington

Region 2 - Haldimand-Norfolk, Oxford, Brant, Hamilton-Wentworth, Niagara

Region 3 - Halton, Dufferin, Peel, York, Durham, Metropolitan Toronto

Region 4 - Bruce, Grey, Simcoe, Victoria, Peterborough, Northumberland, Muskoka, Haliburton, Prince Edward County Hastings, Renfrew, Lennox and Addington, Frontenac

Region 5 - Rainy River, Kenora, Thunder Bay, Cochrane, Algoma, Sudbury, Timiskaming, Manitoulin, Parry Sound, Nipissing

Region 6 - Lanark, Leeds, Ottawa-Carleton, Grenville, Dundas Russell, Prescott, Glengarry, Stormont

A Regional breakdown of waste generation was carried out by determining the number of subject waste generators in each of the six OWMC Ontario Regions and applying previously developed waste generation rates to these numbers. For most service industries, the Dun and Bradstreet (1986) market survey database provided a Regional breakdown. A regional breakdown of households was developed from information provided in the 1986 Municipal Directory.

In the case of Recyclers, industry information was obtained from an OWMC Report (1983), and a Regional breakdown was estimated, based on the size of the companies, and the recycling activity in which they were involved. This information was obtained by contacting a number of the companies directly by phone.

Department of National Defence (DND) wastes were assigned to the Regions in which the Canadian Forces Bases (on which information was provided) were located.

Spills were assigned to various Regions based on historical MOE Spills Action Centre records on spill locations.

CHAPTER 3
RESULTS

This chapter discusses the study results, and identifies the largest waste generators, and the most significant waste types generated in the province by the non-industrial sources addressed in the study. A breakdown of waste generation by Region and the limitations of the study results are also discussed.

3.1 GENERAL

The estimated quantities of subject wastes generated by the non-industrial sources addressed in the study in Ontario are presented in Table 1. Waste descriptions used in the table were those found in the literature and which most accurately describe the types of wastes encountered in the sectors of interest. UCD categories which most accurately describe the various waste groupings are included in the table. In some cases, specific UCD numbers are assigned to more than one waste description. This was necessary in some cases where waste descriptions were not broken down adequately to fit one UCD description only. The most general categories are strong acids and alkalis, (UCD's 111, 112, 113, 121, 122, 123) and non-oil environmental hazardous waste, which is used for intermittent spill data, and covers a wide variety of materials, including naphtha, ammonia, toluene, phosphoric, hydrochloric and sulphuric acid, chlorine, pesticides, etc.

Ignitable paint wastes (UCD 215, 262) are shown separately from spent solvents, as there was a significant

WASTE DESCRIPTION		IGNITABLE PAINT WASTES	OTHER REACTIVE WASTES	STRONG ACIDS AND ALKALIES	SPENT SOLVENTS	AQUEOUS WASTES FROM SOLVENT RECYCLING	STILL BOTTOMS	USED OILS	WASTES FROM OIL RECYCLING	LEAD ACID BATTERIES	ANTIFREEZE	DRY CLEANING FILTER RESIDUE	WASTES WITH AMMONIA	PESTICIDE WASTES	PHOTOGRAPHIC WASTES	PATHOLOGICAL/ BIOMEDICAL WASTES	NON OIL ENVIRONMENTAL HAZARDOUS WASTES	PCB WASTES	OTHER	
	APPLICABLE UCD CATEGORIES	215, 262		111, 112, 113, 121, 122, 123	211-217	141, 142, 143	247, 248	281	247, 248, 268		217	213, 216, 217, 521	113, 131	241, 532	244	528	111-113, 121-129, 141-147, 211-217, 221-228	242			
WASTE SOURCE	NUMBER OF ESTABLISHMENTS	WASTE QUANTITY (Tonnes/Year)																			TOTAL QUANT. (Tonnes/Year)
INSTITUTIONAL																					
EDUCATIONAL FACILITIES	125	6	5	37	371			152											14		585
LAB AND RESEARCH FACILITIES	1,115	25	129	147	790											283			1		1,375
HOSPITALS	265															5,695					5,695
GOVERNMENT INSTITUTIONS		40		10	91			377		37			1	34	67			4	33		595
INTERMITTENT																					
SPILLS								2,936									2,844		-		5,780
HOUSEHOLDS	3,419,970	17,150			3,170			40,937			14,255			5,849					5,490		86,851
COMMERCIAL-SERVICES																					
PHOTOGRAPHIC SECTOR	1,449	2		1	97										2,693				7		2,800
LAUNDRIES AND DRY CLEANERS	917											785							2		787
PESTICIDE END USERS	2,492													1,703					18		1,721
PESTICIDE APPLICATION SERVICES	851													844					7		851
RECYCLERS						2,853	4,433		7,830										69		15,185
VEHICLE MAINTENANCE	19,900	47		1,148	4,125			46,838		32,463									14		84,635
FUNERAL SERVICES	380															206					206
BUILDING CLEANING AND MAINTENANCE	1,056	46		5	9								24						38		122
EQUIPMENT REPAIR	2,179	2		44	1,055														46		1,147
WHOLESALE AND RETAIL SALES	2,094	176		152	267									97					1,351		2,043
TOTAL QUANTITY (Tonnes/Year)		17,494	134	1,544	9,975	2,853	4,433	91,240	7,830	32,500	14,255	785	25	8,327	2,760	6,184	2,844	4	7,090		210,275

Table 1

SUBJECT WASTES PRODUCED BY THE NON-INDUSTRIAL SECTOR IN ONTARIO

volume of this type of waste produced by households, and it was considered worthwhile to show this contribution as a separate heading on the summary table.

Table 1 does not include wastes generated by site clean-up and decommissioning activities. This topic is dealt with in some detail in a separate report by CANVIRO (1988).

3.2 WASTE QUANTITY GENERATION BY SECTOR

Households produce the largest quantity of subject waste, at an estimated 86,650 tonnes per year of solvents, used oils, antifreeze and pesticides, accounting for 41% of the total quantity of subject waste identified in the study. The motor vehicle industry is the second largest generator, producing an estimated 84,635 tonnes per year of solvents, cleaners, used oils and lead acid batteries, and accounting for a further 40% of the total subject waste quantity identified. This quantity can be confirmed when the results of a study currently underway by the MOE Waste Management Branch are available. The recycling industry is the third highest producer of subject wastes, accounting for an estimated 15,185 tonnes per year of still bottoms and miscellaneous residue from solvent recycling and oil recycling activities. The above three sectors account for approximately 89% of the wastes shown on the table.

3.3 QUANTITIES OF WASTE GENERATED BY TYPE

Of the estimated 210,300 tonnes/year of subject wastes generated the greatest single waste type is used oil, at an

estimated 91,240 tonnes per year, or 43% of the identified total. Approximately 51% of this figure is generated by the vehicle maintenance sector and a further 46% is estimated to be generated by households.

The second largest waste type is lead acid batteries, at an estimated 32,500 tonnes per year, or 15% of the identified total. Almost all of this is generated by the vehicle service industry.

The third highest quantity is ignitable paint waste, at an estimated 17,500 tonnes per year, or 8% of the identified total. Almost all of this stream is produced by households. This waste type is shown separately from spent solvents in the summary tables, as it encompasses two UCD categories only.

The fourth highest quantity is antifreeze, at an estimated 14,260 tonnes per year, or 7% of the identified total. All of this quantity was estimated to be generated by households. A rate for waste antifreeze generation by the motor vehicle service industry was not identified in the literature, hence it was not included in this study. However, it is expected that the motor vehicle service sector should add to this total. The MOE study currently underway will address this issue in more detail.

3.4 QUANTITIES OF WASTE GENERATED BY REGION

The quantities of special wastes presented in Table 1 were broken down on a Regional basis, using the six OWMC Ontario Regions described in section 2.4. The methodology used for breaking down waste generation by Region is described briefly in Chapter 2.

Results of this breakdown are presented in Tables 2 to 7, which indicate that the greatest quantities of waste are generated in Region's 3 and 1, which account for approximately 39% and 17% of the total quantity, respectively. OWMC Regions 4, 2, 5 and 6, account for 14%, 11%, 10% and 9% of the total waste generated respectively. The estimated waste quantities produced by each Region are as follows:

Region 1 - 35,500 tonnes/year
Region 2 - 23,600 tonnes/year
Region 3 - 82,200 tonnes/year
Region 4 - 28,700 tonnes/year
Region 5 - 21,000 tonnes/year
Region 6 - 19,300 tonnes/year

It should be noted that for oil recycling wastes, generation was assumed proportional to population in each Region, following a detailed discussion with representatives of the Canadian Association of Re-Refiners. Discussions with members of the solvent recycling industry indicated that the industry is split approximately 80%: 18%: 2% between Regions 3, 1 and 4 respectively, based on still capacity. Wastes from solvent recycling were assigned to each Region on this basis.

Pathological wastes were assigned to the various Regions, based on 1987 manifest data obtained from the MOE Waste Management Branch.

A detailed regional breakdown of household wastes is included in Table 8. Totals shown on this table differ slightly from those on Table 1 because of rounding up to whole digits.

WASTE DESCRIPTION		IGNITABLE PAINT WASTES	OTHER REACTIVE WASTES	STRONG ACIDS AND ALKALIES	SPENT SOLVENTS	AQUEOUS WASTES FROM SOLVENT RECYCLING	STILL BOTTOMS	USED OILS	WASTES FROM OIL RECYCLING	LEAD ACID BATTERIES	ANTIFREEZE	DRY CLEANING FILTER RESIDUE	WASTES WITH AMMONIA	PESTICIDE WASTES	PHOTOGRAPHIC WASTES	PATHOLOGICAL/ BIOMEDICAL WASTES	NON GIL ENVIRONMENTAL HAZARDOUS WASTES	PCB WASTES	OTHER	
	APPLICABLE UCD CATEGORIES	215, 262		111, 112, 113, 121, 122, 123	211-217	141, 142, 143	247, 248	281	247, 248, 288		217	213, 216, 217, 521	113, 131	241, 532	244	528	111-113, 121-123, 141-147, 211-217, 221-228	242		
WASTE SOURCE	NUMBER OF ESTABLISHMENTS	WASTE QUANTITY (Tonnes/Year)																		TOTAL QUANT. (Tonnes/Year)
INSTITUTIONAL																				
EDUCATIONAL FACILITIES	19	1	1	8	85			38						2					3	135
LAB AND RESEARCH FACILITIES	159	4	19	22	110											34				190
HOSPITALS	40															163				163
GOVERNMENT INSTITUTIONS		1		3	1			30		8				1	1				6	51
INTERMITTENT																				
SPILLS								468									96			564
HOUSEHOLDS	575,714	2,887			534			6,891			2,400			961					924	14,597
COMMERCIAL-SERVICES																				
PHOTOGRAPHIC SECTOR	116	1			8										219				1	230
LAUNDRIES AND DRY CLEANERS	113											97							1	98
PESTICIDE END USERS	742													509					6	515
PESTICIDE APPLICATION SERVICES	172													153					1	154
RECYCLERS						513	798		1,368										12	2,691
VEHICLE MAINTENANCE		6		210	754			5,458		5,933									2	15,373
FUNERAL SERVICES	71															38				38
BUILDING CLEANING AND MAINTENANCE	148	6		1	1								3						5	16
EQUIPMENT REPAIR	263	1		7	176														6	192
WHOLESALE AND RETAIL SALES	481	40		35	61									22					310	468
TOTAL QUANTITY (Tonnes/Year)		2,947	20	286	1,730	513	798	15,892	1,368	5,941	2,400	97	3	1,638	220	235	96		1,279	35,456

Table 2

SUBJECT WASTES PRODUCED BY THE NON-INDUSTRIAL SECTOR IN OWMC REGION 1

WASTE DESCRIPTION		IGNITABLE PAINT WASTES	OTHER REACTIVE WASTES	STRONG ACIDS AND ALKALIES	SPENT SOLVENTS	AQUEOUS WASTES FROM SOLVENT RECYCLING	STILL BOTTOMS	USED OILS	WASTES FROM OIL RECYCLING	LEAD ACID BATTERIES	ANTIFREEZE	DRY CLEANING FILTER RESIDUE	WASTES WITH AMMONIA	PESTICIDE WASTES	PHOTOGRAPHIC WASTES	PATHOLOGICAL/ BIOMEDICAL WASTES	NON OIL ENVIRONMENTAL HAZARDOUS WASTES	PCB WASTES	OTHER	
	APPLICABLE UCD CATEGORIES	215, 262		111, 112, 113, 121, 122, 123	211-217	141, 142, 143	247, 248	281	247, 248, 288		217	213, 216, 217, 521	113, 131	241, 532	244	528	111-113, 121-123, 141-147, 211-217, 221-226	242		
WASTE SOURCE	NUMBER OF ESTABLISHMENTS	WASTE QUANTITY (Tonnes/Year)																		TOTAL QUANT. (Tonnes/Year)
INSTITUTIONAL																				
EDUCATIONAL FACILITIES	9	1	1	4	47			20											2	75
LAB AND RESEARCH FACILITIES	89	2	10	12	63											23				110
HOSPITALS	27															570				570
GOVERNMENT INSTITUTIONS																				
INTERMITTENT																				
SPILLS								112									52			164
HOUSEHOLDS	402,961	2,020			374			4,823			1,680			666					647	10,210
COMMERCIAL-SERVICES																				
PHOTOGRAPHIC SECTOR	76	1			5										141				1	148
LAUNDRIES AND DRY CLEANERS	113											97								97
PESTICIDE END USERS	588													403					4	407
PESTICIDE APPLICATION SERVICES	97													86					1	87
RECYCLERS									939											939
VEHICLE MAINTENANCE	2,461	4		142	511			5,758		4,021									2	10,438
FUNERAL SERVICES	57															31				31
BUILDING CLEANING AND MAINTENANCE	92	4		1	1								2						3	11
EQUIPMENT REPAIR	249	1		5	120														5	131
WHOLESALE AND RETAIL SALES	212	18		18	27									10					137	207
TOTAL QUANTITY (Tonnes/Year)		2,051	11	179	1,148			10,713	939	4,021	1,680	97	2	1,166	141	624	52		803	23,626

Table 3

SUBJECT WASTES PRODUCED BY THE NON-INDUSTRIAL SECTOR AND IN OWMC REGION 2

WASTE SOURCE	NUMBER OF ESTABLISHMENTS	WASTE QUANTITY (Tonnes/Year)																	TOTAL QUANT. (Tonnes/Year)
WASTE DESCRIPTION		IGNITABLE PAINT WASTES	OTHER REACTIVE WASTES	STRONG ACIDS AND ALKALIES	SPENT SOLVENTS	AQUEOUS WASTES FROM SOLVENT RECYCLING	STILL BOTTOMS	USED OILS	WASTES FROM OIL RECYCLING	LEAD ACID BATTERIES	ANTIFREEZE	DRY CLEANING FILTER RESIDUE	WASTES WITH AMMONIA	PESTICIDE WASTES	PHOTOGRAPHIC WASTES	PATHOLOGICAL/ BIOMEDICAL WASTES	NON OIL ENVIRONMENTAL HAZARDOUS WASTES	PCB WASTES	OTHER	
APPLICABLE UCD CATEGORIES		216, 262		111, 112, 113, 121, 122, 123	211-217	141, 142, 143	247, 248	281	247, 248, 286		217	213, 216, 217, 621	113, 131	241, 532	244	528	111-113, 121-123, 141-147, 211-217, 221-226	242		
INSTITUTIONAL																				
EDUCATIONAL FACILITIES	57	3	2	15	143			58											6	227
LAB AND RESEARCH FACILITIES	506	13	68	77	431											178			1	779
HOSPITALS	60															4,500				4,500
GOVERNMENT INSTITUTIONS		1			11			36		18										66
INTERMITTENT																				
SPILLS								106									72			180
HOUSEHOLDS	1,329,003	6,664			1,232			15,906			5,539			2,196					2,124	33,662
COMMERCIAL-SERVICES																				
PHOTOGRAPHIC SECTOR	1,010	1		1	67										1,877				2	1,948
LAUNDRIES AND DRY CLEANERS	476											407							1	408
PESTICIDE END USERS	450													309					3	312
PESTICIDE APPLICATION SERVICES	448													397					3	400
RECYCLERS						2,282	3,566		3,222										55	9,114
VEHICLE MAINTENANCE	6,727	11		389	1,396			16,483		10,995									5	29,279
FUNERAL SERVICES	81															44				44
BUILDING CLEANING AND MAINTENANCE	495	21		2	4								11						18	61
EQUIPMENT REPAIR	578	1		18	425														18	462
WHOLESALE AND RETAIL SALES	541	70		51	107									39					524	521
TOTAL QUANTITY (Tonnes/Year)		6,785	70	563	3,816	2,282	3,566	32,593	3,222	11,013	5,539	407	11	2,940	1,877	4,722	72		2,761	82,243

Table 4

SUBJECT WASTES PRODUCED BY THE NON-INDUSTRIAL SECTOR IN OWMC REGION 3

WASTE DESCRIPTION		IGNITABLE PAINT WASTES	OTHER REACTIVE WASTES	STRONG ACIDS AND ALKALIES	SPENT SOLVENTS	AQUEOUS WASTES FROM SOLVENT RECYCLING	STILL BOTTOMS	USED OILS	WASTES FROM OIL RECYCLING	LEAD ACID BATTERIES	ANTIFREEZE	DRY CLEANING FILTER RESIDUE	WASTES WITH AMMONIA	PESTICIDE WASTES	PHOTOGRAPHIC WASTES	PATHOLOGICAL/ BIOMEDICAL WASTES	NON OIL ENVIRONMENTAL HAZARDOUS WASTES	PCB WASTES	OTHER	
	APPLICABLE UCD CATEGORIES	216, 262		111, 112, 113, 121, 122, 123	211-217	141, 142, 143	247, 248	281	247, 248, 288		217	213, 216, 217, 521	113, 131	241, 532	244	528	111-113, 121-123, 141-147, 211-217, 221-228	242		
WASTE SOURCE	NUMBER OF ESTABLISHMENTS	WASTE QUANTITY (Tonnes/Year)																		TOTAL QUANT. (Tonnes/Year)
INSTITUTIONAL																				
EDUCATIONAL FACILITIES	15	1	1	3	26			11											1	45
LAB AND RESEARCH FACILITIES	72	2	8	9	47											21				87
HOSPITALS	46															304				304
GOVERNMENT INSTITUTIONS		35		7	29			253					1	32	13			1	26	397
INTERMITTENT																				
SPILLS								528									1,272			1,800
HOUSEHOLDS	477,484	2,364			443			5,716			1,990			789					767	12,069
COMMERCIAL-SERVICES																				
PHOTOGRAPHIC SECTOR	77	1			5										143				1	150
LAUNDRIES AND DRY CLEANERS	91											78								78
PESTICIDE END USERS	336													230					2	232
PESTICIDE APPLICATION SERVICES														79					1	80
RECYCLERS						57	89		884										2	1,032
VEHICLE MAINTENANCE	2,843	9		166	593			6,464		4,664									2	11,897
FUNERAL SERVICES	84															46				46
BUILDING CLEANING AND MAINTENANCE	74	3		1	1								2						3	10
EQUIPMENT REPAIR	271	1		5	131														6	143
WHOLESALE AND RETAIL SALES	266	22		19	34									12					171	258
TOTAL QUANTITY (Tonnes/Year)		2,466	9	209	1,311	57	89	12,972	884	4,664	1,990	78	3	1,142	156	371	1,276	1	982	28,666

Table 5

SUBJECT WASTES PRODUCED BY THE NON-INDUSTRIAL SECTOR IN OWMC REGION 4

WASTE DESCRIPTION	IGNITABLE PAINT WASTES	OTHER REACTIVE WASTES	STRONG ACIDS AND ALKALIES	SPENT SOLVENTS	AQUEOUS WASTES FROM SOLVENT RECYCLING	STILL BOTTOMS	USED OILS	WASTES FROM OIL RECYCLING	LEAD ACID BATTERIES	ANTIFREEZE	DRY CLEANING FILTER RESIDUE	WASTES WITH AMMONIA	PESTICIDE WASTES	PHOTOGRAPHIC WASTES	PATHOLOGICAL/ BIOMEDICAL WASTES	NON OIL ENVIRONMENTAL HAZARDOUS WASTES	PCB WASTES	OTHER	
APPLICABLE UCD CATEGORIES	216, 262		111, 112, 113, 121, 122, 123	211-217	141, 142, 143	247, 248	251	247, 248, 266		217	213, 216, 217, 521	113, 131	241, 532	244	526	111-113, 121-123, 141-147, 211-217, 221-226	242		
WASTE SOURCE	NUMBER OF ESTABLISHMENTS	WASTE QUANTITY (Tonnes/Year)																	TOTAL QUANT. (Tonnes/Year)
INSTITUTIONAL																			
EDUCATIONAL FACILITIES	9	1	1	2	18			7										1	30
LAB AND RESEARCH FACILITIES	76	2	10	11	56										5				86
HOSPITALS	65														28				28
GOVERNMENT INSTITUTIONS		4		1	6			20									3	1	35
INTERMITTENT																			
SPILLS								1,640								300			1,940
HOUSEHOLDS	269,830	1,453			269			3,469			1,208			479				465	7,343
COMMERCIAL-SERVICES																			
PHOTOGRAPHIC SECTOR	46	1			3													1	90
LAUNDRIES AND DRY CLEANERS	67													85					87
PESTICIDE END USERS	270											57							57
PESTICIDE APPLICATION SERVICES	51												185					2	187
RECYCLERS													45					1	46
VEHICLE MAINTENANCE	2,488	9		143	515			5,477	644	4,048									644
FUNERAL SERVICES	45																	2	10,194
BUILDING CLEANING AND MAINTENANCE	161	7		1	1										24				24
EQUIPMENT REPAIR	220	1		4	106							4						6	19
WHOLESALE AND RETAIL SALES	117	10		9	15								5					5	116
TOTAL QUANTITY (Tonnes/Year)		1,488	11	171	991			10,613	644	4,048	1,208	57	4	714	85	57	300	3	75	114
																			559	20,963

Table 6

SUBJECT WASTES PRODUCED BY THE NON-INDUSTRIAL SECTOR IN OWMC REGION 5

WASTE DESCRIPTION		IGNITABLE PAINT WASTES	OTHER REACTIVE WASTES	STRONG ACIDS AND ALKALIES	SPENT SOLVENTS	AQUEOUS WASTES FROM SOLVENT RECYCLING	STILL BOTTOMS	USED OILS	WASTES FROM OIL RECYCLING	LEAD ACID BATTERIES	ANTIFREEZE	DRY CLEANING FILTER RESIDUE	WASTES WITH AMMONIA	PESTICIDE WASTES	PHOTOGRAPHIC WASTES	PATHOLOGICAL/ BIOMEDICAL WASTES	NON OIL ENVIRONMENTAL HAZARDOUS WASTES	PCB WASTES	OTHER	
	APPLICABLE UCD CATEGORIES	215, 262		111, 112, 113, 121, 122, 123	211-217	141, 142, 143	247, 248	261	247, 248, 266		217	213, 216, 217, 521	113, 131	241, 532	244	528	111-113, 121-123, 141-147, 211-217, 221-228	242		
WASTE SOURCE	NUMBER OF ESTABLISHMENTS	WASTE QUANTITY (Tonnes/Year)																		TOTAL QUANT. (Tonnes/Year)
INSTITUTIONAL																				
EDUCATIONAL FACILITIES	16	1	1	5	50			20											1	78
LAB AND RESEARCH FACILITIES	111	3	13	12	77											22				127
HOSPITALS	27															130				130
GOVERNMENT INSTITUTIONS					43			38		7					53					141
INTERMITTENT																				
SPILLS								84									1,052			1,136
HOUSEHOLDS	344,978	1,730			320			4,129			1,438			570					554	8,741
COMMERCIAL-SERVICES																				
PHOTOGRAPHIC SECTOR	122	1		1	8										227				1	238
LAUNDRIES AND DRY CLEANERS	57											49								49
PESTICIDE END USERS	98													67					1	68
PESTICIDE APPLICATION SERVICES	84													83					1	84
RECYCLERS									783										1	784
VEHICLE MAINTENANCE	1,729	8		99	357			4,186		2,806									1	7,457
FUNERAL SERVICES	42															23				23
BUILDING CLEANING AND MAINTENANCE	86	3		1	1								2						3	10
EQUIPMENT REPAIR	198	1		4	96														4	105
WHOLESALE AND RETAIL SALES	178	15		13	23									8					114	173
TOTAL QUANTITY (Tonnes/Year)		1,762	14	135	975			8,457	783	2,813	1,438	49	2	728	280	175	1,052		681	19,344

Table 7

SUBJECT WASTES PRODUCED BY THE NON-INDUSTRIAL SECTOR IN OWMC REGION 6

OWMC REGION	01 WINDSOR	02 BRANTFORD	03 ST CATHARINES NIAGARA	07 TIMMINS	08 HAMILTON	09 CHATHAM	010 OTHER SW	011 SARNIA	012 OTHER SC	013 OTHER SE	014 OTHER NE	015 OTHER NW	016 THUNDER BAY	017 BARRIE	018 LONDON	019 KITCHENER	020 TORONTO	021 OSHAWA	022 GUELPH	023 SAULT STE MARIE	024 STRATFORD	025 SUDBURY	026 PETERBOROUGH	027 NORTH BAY	028 BELLEVILLE	029 KINGSTON	030 BROCKVILLE	031 OWEN SOUND	032 OTTAWA	033 CORNWALL	
NUMBER OF HOUSEHOLDS	118775	92811	139254	46861	204617	39813	21522	47582	80248	70166	33008	22826	53874	94213	163806	116588	1172963	105848	49574	47621	24393	63637	50174	22026	48662	50295	35845	104551	242813	55604	TOTAL HOUSEHOLDS: 3419970
WASTE TYPES:																															TOTAL QUANTITIES: (Tonnes/yr)
Ignitable Paint Waste	595	465	698	235	1025	200	108	238	402	352	165	114	270	472	821	584	5877	530	248	239	122	319	251	110	244	252	180	524	1216	279	17135
Spent Solvents	110	86	129	43	190	37	20	44	74	65	31	21	50	87	152	108	1089	98	46	44	23	59	47	20	45	47	33	97	225	52	3172
Used Oils	1422	1111	1667	561	2449	477	258	570	961	840	395	273	645	1128	1961	1396	14040	1267	593	570	292	762	601	264	582	602	429	1251	2906	666	40939
Antifreeze	495	387	581	195	853	166	90	198	335	293	138	95	225	393	683	486	4891	441	207	199	102	265	209	92	203	210	149	436	1013	232	14262
Pesticide Wastes	196	153	230	77	338	66	36	79	132	116	54	38	89	155	270	192	1935	175	82	79	40	105	83	36	80	83	59	173	401	92	5644
Other	190	148	223	75	327	64	34	76	128	112	53	37	86	151	262	187	1877	169	79	76	39	102	80	35	78	80	57	167	389	89	5470
TOTAL QUANTITY (Tonnes/yr)	3008	2350	3528	1186	5182	1010	546	1205	2032	1778	836	578	1365	2386	4149	2953	29709	2680	1255	1207	618	1612	1271	557	1232	1274	907	2648	6150	1410	86622

Table 8
QUANTITIES OF SUBJECT WASTE GENERATED BY THE RESIDENTIAL SECTOR IN ONTARIO - BY OWMC REGION
(All Quantities In Tonnes/Year)

3.5 LIMITATIONS OF DATA

3.5.1 BIOMEDICAL/PATHOLOGICAL WASTES

Biomedical wastes for the Province were initially calculated assuming a total number of 49,719 beds and cribs obtained from the Statistics Canada List of Canadian Hospitals and Special Care Facilities (1983). Biomedical waste generation rates were obtained from a number of studies. A USEPA Study (1974) by the University of Minnesota found rates of 2.1-7.4 Kg/patient/day (mean 3.9 Kg/patient/day). A Synergy West Ltd. (1974) Study of Alberta Hospitals concluded that infectious wastes varied from 0.7-2.4 Kg/patient/day, the lower generation rate being attributed to the fact that Canadian hospitals used less disposables. A study carried out by the Ontario Hospital Association (1984) concluded that hospitals produced 0.6 Kg/patient per day of biomedical wastes, but cautioned that they felt respondents were unclear as to the definition of biomedical wastes.

Biomedical waste generation rates are discussed in the interministry task force on biomedical waste report (1986) which quoted the following references:

	References	Biomedical Waste Generation Rate
1.	MOE (1985)	0.75 kg/day for each special care patient based on 75 responses from 164 facilities
2.	Consultants Report on Incinerator Design (1985)	2.3-7.7 kg per patient per day

References	Biomedical Waste Generation Rate
3. Environment Canada Report on Royal Jubilee Hospital, B.C.	2.4 kg/patient per day
4. Pollock-Report on U.S. West Coast Hospitals	7.5 kg/patient/day
5. Kremer, Airan Reports on other U.S. hospitals	7.5 kg/patient/day

The interministry task force recommended that a biomedical waste generation rate of 6 kg/patient/day be used for sizing of hospital incinerators. This is a conservative figure used to ensure adequate sizing of hospital facilities.

Discussions with personnel at a number of hospitals, and also with MOE Waste Management Branch staff indicated that biomedical waste as defined in many of these studies is a general term referring to all waste which leaves hospital wards and includes food wastes, and newspapers etc., most of which is disposed as municipal waste. Obviously, not all of this biomedical waste is of interest to the OWMC, hence the present study focussed on the pathological component of biomedical waste. Detailed manifest data were obtained from the MOE Waste Management Branch, on all waste manifested as MOE Waste Class 312P (Pathological) for 1986 and 1987.

Biomedical/pathological wastes produced by medical laboratories were estimated using a generation rate of 0.2 kg/patient/day quoted in the interministry task force report (1986), and assuming that each laboratory sees approximately 8,000 patients per year (4 patients per hour).

3.5.2 SPILLS

Table 1 includes quantities of materials reported as spilled to the MOE Spills Action Centre, and increased by a factor of 2 to account for those spills which occur, but are not reported directly. In some cases the quantity of waste generated as a result of a spill could be significantly greater than the quantity of material actually spilled. These materials could include contaminated soil, absorbants used to clean-up the spill etc. MOE Spills Action Centre records show that 85% of spilled oils and 18% of spilled non-oil environmental hazardous materials are recovered. Assuming that the balance of the spilled materials migrate into the underlying soils, it was estimated that up to 27,740 tonnes of soil contaminated with oil, and 132,240 tonnes of soil contaminated with other material could be produced for a total of 5780 tonnes of spilled material shown on Table 1. These calculations were based on the following assumptions:

(i) The underlying soils will absorb 15 litres of spilled fluid per cubic meter of soil (F. Schwille, 1984).

(ii) The average bulk density (γ) of contaminated soil is 1.7 grams per cubic centimeter (Peck et al, 1974). The bulk density is used for calculation of the weight of contaminated soil requiring disposal.

Spill clean-up wastes are generally not considered subject waste, and in many cases where contaminated soil is excavated and removed, it can be disposed at a licenced municipal landfill. Some recent projects have tended to favour onsite remediation of damage caused by spills, either by biological or physical-chemical means. Because of the variability of circumstances involving spill clean-ups an estimate of clean-up material resulting from spills has not been included in Table 1. The various approaches to spill clean-up are addressed in detail in CANVIRO (1988).

CHAPTER 4
CONCLUSIONS AND RECOMMENDATIONS

4.1 CONCLUSIONS

- An estimated 210,300 tonnes of subject waste is produced in Ontario by the non-industrial sources addressed in this study. Of this quantity, used oil is the single largest waste type, at an estimated 91,240 tonnes, followed by lead acid batteries and ignitable paint wastes. The above waste types account for 43%, 15%, and 8% of the total quantity produced.

- Householders are the largest single generators of subject wastes identified in this study, followed by the vehicle maintenance sector. Each of these sectors generates approximately 40% of the total quantity of subject waste identified in this study.

- A Regional breakdown indicates that most of the waste is produced in Southern Ontario, with 39% estimated from Region 3, and 17% from Region 1, and the remaining 44% from the other four Regions.

- Adequate information was not available on wastes from intermittent sources such as spills to include these in the above figures.

- Adequate information was not available on biomedical/pathological wastes from dental laboratories or veterinary services, and antifreeze generated by the motor vehicle service industry.

Recommendations

- The information in this report should be updated when MOE studies on wastes produced by the drycleaning and motor vehicle service industry in Ontario are published.

APPENDIX A

REFERENCES

REFERENCES

1. Abt Associates Inc., National Small Quantity Hazardous Waste Generator Survey, EPA/530-SW-85-004, U.S. EPA, Washington, D.C. (1985).

2. Association of Universities and Colleges of Canada, Directory of Canadian University, 1984-1985.

3. Blackmar, D.S., Results of a Regional Household Hazardous Waste Collection Program in Barnstable County, Massachusetts, Hazardous Waste, Vol. 1, No. 1, pp. 111-122 (1984).

4. Brinkman, D.W., et al, Used Metal Oil Poses Environmental Problem, Oil and Gas J., pp. 163-165 (1982).

5. CANVIRO Consultants, Wastes generated from site clean-up and decommissioning activities in Ontario, Draft report submitted to the Ontario Waste Management Corporation, May 1988.

6. Energy Pathways Inc., A Report on the Feasibility of Solvent and Solvent Bottle Recycling at Federal Laboratories in the National Capital Region, Prepared for EPS, Environment Canada (1984).

7. Health Care Occupational Health and Safety Association (A Division of the Ontario Hospital Association), Report of the Results of the Biomedical Waste Management Survey, (1985).

8. Journal of Chemical Education, Safety in the Chemical Laboratory, (1970).

9. Manuel, J., A Strategy for the Management of Biomedical Waste (Interministry Task Force on Biomedical Waste (1986).

10. Ministry of Municial Affairs, Municipal Directory (1986).

11. Ontario Ministry of the Environment, Annual Spill Report Summaries, 1981-1984,(1987).

12. Ontario Ministry of the Environment, Letter to CANVIRO from Brian Hogarth, Special Waste Policy and Programs Unit, Waste Management Branch, January 1988.

13. Ontario Waste Management Corporation, University of Toronto Laboratory Wastes, Internal Memo from Mr. A.R. Hale, Sept. (1986).

14. Ontario Waste Management Corporation, Waste Reduction Opportunities Study (1983).

15. Pillsworth, D., An Overview of Waste Lubricating Oil Generation, Recovery and Re-Use, Prepared for Waste Management Division, EPS, Environment Canada (1985).

16. Rathje, W.L., A Characterization of Household Solid Waste, The Garbage Project, University of Arizona (1986).

17. Rathje, W.L. et al, Characterization of Household Hazardous Waste from Marin County, California and New Orleans, Louisiana, prepared for USEPA Environmental Monitoring Systems Laboratory (1987).

18. Statistics Canada, Business Registry File (1986).

19. Tiffany, H.E., Educating the Individual Automobile Owner, J. of Assoc., of Petroleum Re-Refiners, pp. 216-218 (1982).

APPENDIX B

BIBLIOGRAPHY

BIBLIOGRAPHY

Abt Associates Inc., National Small Quantity Hazardous Waste Generator Survey, EPA/530-SW-85-004, U.S. EPA, Washington, D.C. (1985).

Bird and Hale Ltd., et al, Municipal Refuse Statistics for Canadian Communities of over 100,000, Prepared for Waste Management Branch, Environmental Protection Service, Environment Canada.

Blackmar, D.S., Results of a Regional Household Hazardous Waste Collection Program in Barnstable County, Massachusetts, Hazardous Waste, Vol. 1, No. 1, pp. 111-122 (1984).

Bowerman, E.W., et al, Safety Handbook, Chemistry Dept., Ohio State University, Safety in the Chemical Laboratory, Vol. 2 (1982).

Brinkman, D.W., et al, Used Metal Oil Poses Environmental Problem, Oil and Gas J., pp. 163-165 (1982).

Brunner, C.R., Biomedical Waste Incineration presented at 80th APCA Annual Meeting, June 1987.

Campus Waste Brokers, J. of Solid Wastes Management, Vol. 24, No. 11 (1981).

Chemical Engineering, Waste Rules Set to the Little Guy, April 14 (1986).

Chemical Marketing Reporter, Hazardous Waste Rules Extended to Small Sources Under New Proposals, Aug. 12 (1985).

Chemical Week, EPA Focuses on Small Quantity Generators of Hazardous Waste, Vol. 138, No. 14 (1986).

Chemical Week, Small Generators Ship Waste Off-Site, EPA Reports, March 20 (1985).

Cooper, J.S., "Cleaning Up Federal Facilities, EPA Journal, Vol. 10, No. 8 (1984).

Department of National Defence, Summary Data on Hazardous Wastes Generated by DND Bases in Ontario, received from A. Downs, National Defence Headquarters, Ottawa (1987).

Doyle, B.W., The Smoldering Question of Hospital Wastes, J. of Pollution Eng., Vol. 17, No. 7 (1985).

Dreesen, D.W., The University of Georgia Chemical Waste Disposal Program, J. of Env. Health, Vol. 43, No. 1 (1980).

Dun and Bradstreet, Market Survey Data (1987).

Eisenhower, B.M., Hazardous Materials Management and Control Program at Oak Ridge National Laboratory-Environmental Protection, AM. Ind. Hyg. Assoc. J., Vol. 45, No. 4 (1984).

Energy Pathways Inc., A Report on the Feasibility of Solvent and Solvent Bottle Recycling at Federal Laboratories in the National Capital Region, Prepared for EPS, Environment Canada (1984).

Environmental Protection Service, Hazardous Wastes Inventory Report, EPS, Atlantic Region (1980).

EPA, Understanding the Small Quantity Generator, Hazardous Waste Rules: A Handbook for Small Business, EPA/530-SW-86-019 (1986).

EPA, Guide for Infectious Waste Management, EPA/530-SW-86-014, May 1986.

The Garbage Project, Estimation and Evaluation of Hazardous Materials in Residential Solid Waste: The Dangers of Ground Water Pollution, A Proposal to Environmental and Water Quality Engineering, National Science Foundation (1985).

Hall, C.V., Pesticide Waste Disposal in Agriculture, AM. Chem. Soc., pp. 27-36 (1984).

Health Care Occupational Health and Safety Association (A Division of the Ontario Hospital Association), Report of the Results of the Biomedical Waste Management Survey, (1985).

Hoffman, E.J., Waste Lubricating Oil Disposal Practices in Providence, Rhode Island: Potential Significance to Coastal Water Quality, Coastal Zone Management J., Vol. 8, No. 4 (1980).

Implement and Tractor, Update: New EPA Rules Affect Dealers, October (1985).

Jan. W., Characterization of Hazardous Wastes from Small Quantity Waste Generaters (Non-Manufacturing)-A Preliminary Overview, Waste Management Branch, EPS, Environment Canada (1984).

Krause, C., Silver Recovery from ORNL Wastes, Oak Ridge Natl. Lab Review, Vol. 15, No. 4 (1982).

Lenox Inst. for Research Inc., Hazardous Waste Management in Institutions and Colleges, Prepared for Berkshire County Regional Planning Commission, Pittsfield, Ma. (1985).

Love and Associates Ltd., Report on the Pathological Waste Survey, Prepared for the Ontario Ministry of the Environment, Pathological Waste Committee (1974).

Lupien, P., Implementation of a Silver Recovery Program for Photosensitized Material, EPS, Ontario Region, Ottawa District Office (1986).

Metropolitan Separate School Board, Chemical Inventory (1982).

Municipality of Metropolitan Seattle-Metro, Household Hazardous Waste Disposal Project, Metro Toxicant Program Report No. 1A, Prepared for EPA, Seattle, WA. (1982).

Ontario Ministry of the Environment, Annual Spill Report Summaries, 1981-1984.

Ontario Waste Management Corporation, University of Toronto Laboratory Wastes, Internal Memo from Mr. A.R. Hale, Sept. (1986).

Ontario Waste Management Corporation, Visit to McMaster University, Re: Lab Packs, Internal Memo from Mr. A.R. Hale, Sept. (1986).

Ontario Waste Management Corporation, Waste Reduction Opportunities Study (1983).

Pearsall, S.G., et al, The Disposal of Chemical and Radioactive Waste, Safety in the Chemical Laboratory, Vol. 2 (1982).

PEDCO - Environment Inc., Madison Seminar Proceedings: Waste Management in Universities and Colleges-July 9-11, Prepared for EPA, Chicago, IL. (1980).

Pillsworth, D., An Overview of Waste Lubricating Oil Generation, Recovery and Re-Use, Prepared for Waste Management Division, EPS, Environment Canada (1985).

Rathje, W.L., A Characterization of Household Solid Waste, The Garbage Project, University of Arizona (1986).

Regional Municipality of Peel, Data on Hazwaste Days received from E.S. Mead of the Waste Management Division (1987).

Resource Integration Systems Ltd., Household Hazardous Waste Management: The North American Experience, Prepared for the Ontario Ministry of the Environment (1985).

Sanders H.J., Hazardous Wastes in Academic Labs, Corden Washington, Feb. 3 (1986).

Schmidt, I.R., Survey of Collection, Recycling and Safe Disposal of Hospital Wastes in Member States of the European Communities (1982).

Shen, T.T., Toxic Waste Disposal, Civil Engineering for Practicing and Design Engineers, Vol. 2 (1983).

Statistics Canada, Business Registry File (1986).

Synergy West Ltd., Solid Waste Handling and Disposal in Alberta Hospitals, Prepared for Alberta Dept. of Env. Poll. Control Div. (1975).

Syracuse University-Technology and Information Policy Program, New Jersey Small Quantity Generator Survey and Analysis, Prepared for New Jersey Hazardous Waste Facilities Siting Commission, CN-406, Trenton, New Jersey (1986).

Tacoma-Pierce County Health Dept., Small Generator Demonstration Project, Prepared for EPA, Seattle, WA. (1985).

Temple, Barker and Sloane Inc., Regulatory Impact Analysis of Proposed Standards for the Management of Used Oil, Prepared for EPA Office of Solid Waste, Economic Analysis Branch (1985).

Teske, J.W., Chemical Waste Disposal at the University of Minnesota, Safety in the Chemical Laboratory, Vol. 3 (1982).

Tiffany, H.E., Educating the Individual Automobile Owner, J. of Assoc., of Petroleum Re-Refiners, pp. 216-218 (1982).

U.S. EPA, Hospital Wastes, EPA No. SW-129 (1974).

Voeglein, J.F. Jr., Storage and Disposal of Dangerous Chemicals, Safety in the Chemical Laboratory, Vol. 2 (1982).

Wardrop and Associates Ltd., Inventory of Hazardous Waste in the Northwest Region, Prepared for EPS, Fisheries and Environment Canada (1979).

Wilson, D.C., The Implications of Behavioural Aspects on the Production and Discard of Household Hazardous Wastes, Master of Arts Thesis, University of Arizona (1985).

Wu, J.S., et al, Waste Management for Small Quantity Generators in North Carolina, AICHE Summer National Meeting, Paper No. 55d (1984).

Young, I.G., et al, Control of Laboratory and Pilot Plant Waste Water Effluents, Safety in the Chemical Laboratory, Vol. 3 (1982).

APPENDIX C

LIST OF CONTACTS

Name	Affiliation	Telephone Number
Mr. W. Jan	Waste Management Branch, Environmental Protection Service	(613)994-3149
Mr. D. Campbell	Waste Management Branch, Environmental Protection Service	(819)953-1119
Dr. W. Rathje	Dept. of Anthropology University of Arizona	(602)621-6290
Ms. J. Stone	Dept. of National Defense	(613)992-4119
Mr. R. Wells	Abt. Associates Inc., Cambridge, MA	(617)492-7100
Mr. E. Ruder	Abt Associates Inc., Cambridge, MA	(617)926-0009
Mr. J. Reinhart	Environmental Policy Dept. U.S. Environmental Protection Agency	(617)491-7332
Ms. S. Boyle	New Jersey Dept. of Environmental Conservation	(609)984-3728
Mr. S. Hoffman	Hazardous Waste Division CH2M Hill, Reston, Va.	(703)471-1441
Mr. J. Clark	Tempo, Barker and Sloane Ltd., Lexington, MA.	(617)861-7580
Mr. B. Reid Mr. C. Lough	Pope Reid and Assoc. St. Paul, Minn.	(612)227-6500
Small Business Ombudsman Hotline	U.S. Environmental Protection Agency	1(800)368-5888
Mr. B. Crawford	Morley Bedford Funeral Chapel	(416)489-8733
Mr. R. Valentine	Spills Action Center Ministry of the Environment	(416)965-9648
Mr. B. Singh	Toronto Regional Office Ministry of the Environment	(416)424-3000
Dr. Miller	Dept. of Pathology University of Guelph	(519)823-4656
Mr. P. Taylor	Recycling Council of Ontario	(416)593-1756

Name	Affiliation	Telephone Number
Mr. D. Fisher	Association of Canadian Re-refiners	(416)461-7511
Mr. J. McGregor	Anachemia Solvents Ltd.	(416)279-5122
Mr. G. Wentland	Anachemia Solvents Ltd.	(416)279-5122
Mr. A. Hale	Ontario Waste Management Corporation	(416)923-2918
Mr. A. Brown	Physical Resources Dept. University of Guelph	(519)823-3303
Mr. Gemmel	Vehicle Services Dept. University of Guelph	(519)823-2472
Mr. J. Fletcher	Ontario Veterinary College	(519)823-8800
Mr. I. Krahn	Ontario Health Care Occupational Health and Safety Assc.	(416)429-2661
Mr. E. Meadd	Department of Public Works The Regional Municipality of Peel	(416)791-9400
Mr. R. Booth	Environment Contaminants Division, Environmental Protection Service	(416)965-5840
Mr. H. Wong	Waste Management Branch Ministry of the Environment	(416)323-5211
Dr. B. Laughlin	Ontario Research Foundation	(416)822-4111
Mr. K. McTeer	Transport Canada	(416)224-3492
Mr. R. Khettry	Waste Mangement Branch Ministry of the Environment	(416)323-5226
Mr. H. Carter	Texaco	(416)498-2351
Mr. D. Metcalfe	CANVIRO Consultants Waterloo	(519)579-3500